CCA33 — OPERATIONS RESEARCH

Time : Three hours   Maximum : 75 marks

SECTION A — $(10 \times 2 = 20$ marks$)$

Answer ALL the questions.

1. What is Operations Research?

2. Define objective function of the general LPP.

3. How many constraints are there $m \times m$ transportation problem. How many of then are independent?

4. Describe mathematical formulation of an assignment problem.

5. Define total elapsed time.

6. Making use of an example discuss the need for job sequencing.

7. When do you say an activity critical?

8. Given any two applications of CPM/PERT.

9. What is shortest route problem?

10. What are the common errors in construction of a network?

SECTION B — (5 × 5 = 25 marks)

Answer ALL the questions.

11. (a) Write about the models in operation research.

Or

(b) Solve the following LPP by graphical method.

Minimize $Z = 20x_1 + 10x_2$

Subject to $x_1 + 2x_2 \leq 403$

$$x_1 + x_2 \geq 30$$
$$4x_1 + 3x_2 \geq 60$$
$$x_{1,2} \geq 0.$$

12. (a) Assign three jobs on three machines for following cost matrix.

Jobs	Machines		
	M1	M2	M3
J1	Rs. 14	Rs. 12	Rs. 16
J2	Rs. 11	Rs. 17	Rs. 21
J3	Rs. 20	Rs. 8	Rs. 7

Or

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19. Draw a network diagram and identify a critical path from the following table:

Activity : 1-2 1-3 2-3 2-5 3-4 3-6 4-5 4-6 5-6 6-7

Duration (weeks) : 15 15 3 5 8 12 1 14 3 14

Critical path is 1 - 2 - 3 - 4 - 6 - 7 with 54 weeks.

20. Write down the steps used in solving Network model using Fulkerson's Rule.

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(b) Solve the following assignment problem.

Job

$$\text{Person} \quad \begin{array}{c} A \\ B \\ C \\ D \\ E \end{array} \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 8 & 4 & 2 & 6 & 1 \\ 0 & 9 & 5 & 5 & 4 \\ 3 & 8 & 9 & 2 & 6 \\ 4 & 3 & 1 & 0 & 3 \\ 9 & 5 & 8 & 9 & 5 \end{pmatrix}$$

13. (a) Six jobs go first over machine I and there over machine II. The order of the completion of jobs has no significance. The following table gives the machine times in hours for six jobs and the two machines.

Job Nos. :	1	2	3	4	5	6
Time on Machine 1 :	5	9	4	7	8	6
Time on Machine 2 :	7	6	8	3	9	5

Or

(b) Solve the following sequencing problem giving an optimal solution when passing is not allowed.

	A	B	C	D	E
Machine M_1	10	12	8	15	16
Machine M_2	3	2	4	1	5
Machine M_3	5	6	4	7	3
Machine M_4	14	7	12	8	10

14. (a) A small project consist of 12 activities, for which the relevant data are given below.

Activity :	A	B	C	D	E	F	G	H	I	J	K	L
Proceeding Activities :	–	–	–	BC	A	C	E	E	DFH	E	IJ	G
Durantion (days) :	9	4	7	8	7	5	10	8	6	9	10	2

Draw the net work and find the project completion time.

Or

(b) Tasks A,B,C,... H, I constitute a project, The precedence relationship are $A < D$; $A < E$; $B < F$; $D < F$; $C < G$; $C < H$; $F < I$; $G < I$.

Draw a network to represent the project and find the minimum time of completion of the project when time, in days of each task is as follows;

Task :	A	B	C	D	E	F	G	H	I
Time :	8	10	8	10	16	17	18	14	9

15. (a) Write notes on augmenting path algorithm.

Or

(b) Explain the minimum Spanning tree with an example.

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SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Use Simplex method to solve the following LPP.

Max $Z = 4x_1 + 10x_2$

Subject to

$$2x_1 + x_2 \le 50$$
$$2x_1 + 5x_2 \le 100$$
$$2x_1 + 3x_2 \le 90$$
$$x_1, x_2 \ge 0$$

17. Solve the following transportation problem.

	D_1	D_2	D_3	D_4	Supply
S_1	8	4	1	5	70
S_2	8	9	2	7	55
S_3	4	3	6	2	70
Demand	85	35	50	45	

18. Determine a optimal sequence of jobs minimum elapsed time and idle time of machines (in hrs)for the following.

Job	Machines					
	A	B	C	D	E	F
1	19	8	8	3	11	24
2	18	6	9	6	9	18
3	12	5	8	5	7	15
4	20	5	3	4	8	11

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